

Plant Hormones and Tropisms

Mark Scheme



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1. Plant hormones are chemical messengers that play a crucial role in coordinating a plant's growth and development, including its responses to environmental stimuli, known as tropisms.

Circle the letter of the correct answer for each question below.

- a) Which hormone is important in the fruit ripening process in plants?

C – is the only correct answer.	1 mark
	Total: 1 mark

- b) In an experiment to investigate phototropism, a plant shoot is grown with light coming from one side only. After two days, in which region has the greatest rate of growth occurred?

A – is the only correct answer.	1 mark
	Total: 1 mark

- c) Plants growing in swamps have special roots that grow **upwards** through waterlogged soil to get oxygen from air. What type of response do these roots show?

B – is the only correct answer.	1 mark
	Total: 1 mark

- d) A plant nursery owner wants to encourage a batch of dormant seeds to germinate more quickly and uniformly. Which plant hormone would be most effective for this purpose?

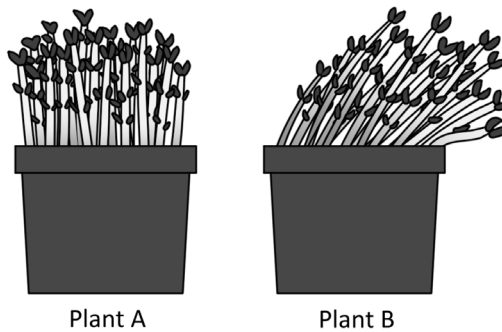
C – is the only correct answer.	1 mark
	Total: 1 mark

- e) A farmer notices that some of their stored apples are causing nearby unripe bananas to ripen much faster than expected. This accelerated ripening is primarily due to the release of which plant hormone?

A – is the only correct answer.	1 mark
	Total: 1 mark

(Total for Question 1 is 5 marks)

2. The figure below shows two plants that have been kept in different conditions.



a) State the location of the main light source in which plant A and plant B were kept.

A statement to include the following:	
Plant A – light is from above / all around.	1 mark
Plant B – light is from the right. Accept: light coming from the right hand side.	1 mark
	Total: 2 marks

b) What is the growth response shown by plant B?

<u>Positive phototropism.</u>	1 mark
Marking note: positive must be stated for the mark to be awarded.	
	Total: 1 mark

c) Explain the advantage of this growth response to plant B.

An explanation to include the following:	
Plant or leaves can absorb more light.	1 mark
for photosynthesis. Second mark is dependent on the first.	1 mark
	Total: 2 marks

d) Identify the plant hormone responsible for this growth and state where this hormone is produced in the plant.

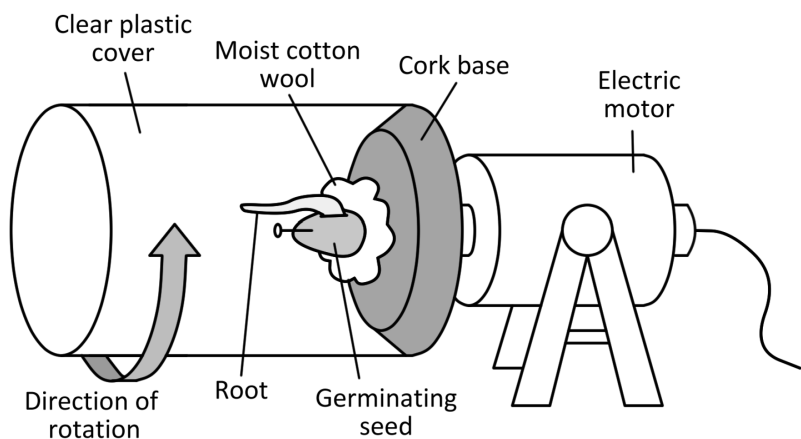
Auxin.	1 mark
Produced in the tip(s) of the shoot(s) or stem(s). Allow apex for tip.	1 mark
	Total: 2 marks

e) The plant hormone from part (d) controls the growth responses of the plants in the figure above.

Explain how this hormone controls the growth response of the seedlings in plant B.

An explanation to include four of the following:	
- Auxin moves / diffuses to the shaded side (of the shoot). - So, there is a higher concentration of auxin on the shaded side. - Auxin causes/stimulates cell elongation / cells to get longer. - Therefore, cells on the shaded side elongate more / grow faster. - This causes the shoot to bend/grow towards the light.	
	Total: 4 marks

The figure below shows the apparatus used by another student to investigate the tropism of a different plant.



f) When the apparatus rotates, the root grows horizontally.

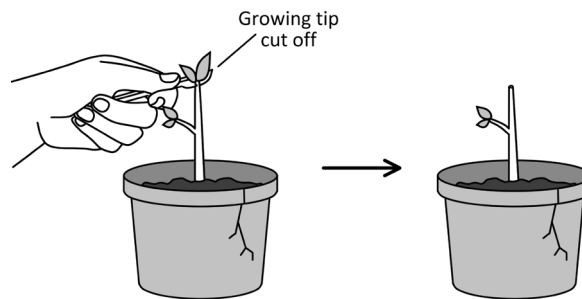
Which tropism is **not** showing its usual effect on the root?

A – is the only correct answer.	1 mark
	Total: 1 mark

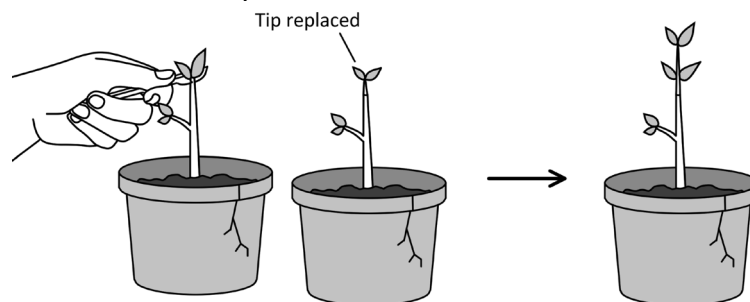
(Total for Question 2 is 12 marks)

3. A student did an experiment on the growth of plant shoots.
The figure below shows the apparatus used in the investigation.

Experiment 1: The tip of a shoot was removed from the plant. There was no growth in the shoot after 3 days.



Experiment 2: The tip of a shoot was cut off and then replaced back onto the same shoot. The shoot had grown 10 mm after 4 days.



- a) Describe the role of the shoot tip in enabling a plant to grow towards a light source.

A description to include the following:	
(The shoot tip) produces a hormone / auxin.	1 mark
(The shoot tip) detects the stimulus / direction of light.	1 mark
Allow chemical / substance for hormone.	
	Total: 2 marks

- b) Give **one** variable that must have been controlled for the plant shoot to grow vertically, as shown in experiment 2.

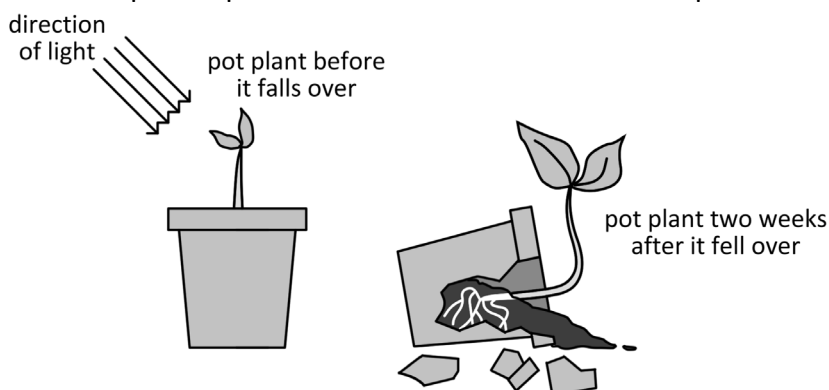
Accept any one of the following:	
• Direction of light • Light intensity • Temperature • Availability of water • Availability of carbon dioxide • Soil minerals / ions	
	Total: 1 mark

- c) State **one** conclusion that could be made based on these two experiments.

A conclusion to include:	
The tip produces a substance / hormone / chemical that causes growth.	1 mark
Allow 'the tip is required for growth'.	
Do Not Allow 'growth happens in the tip'.	
	Total: 1 mark

A person knocked over a potted plant in a garden and the pot broke. The plant was left where it fell for over three weeks.

The figure below shows the potted plant when it first fell and the same plant over three weeks later.



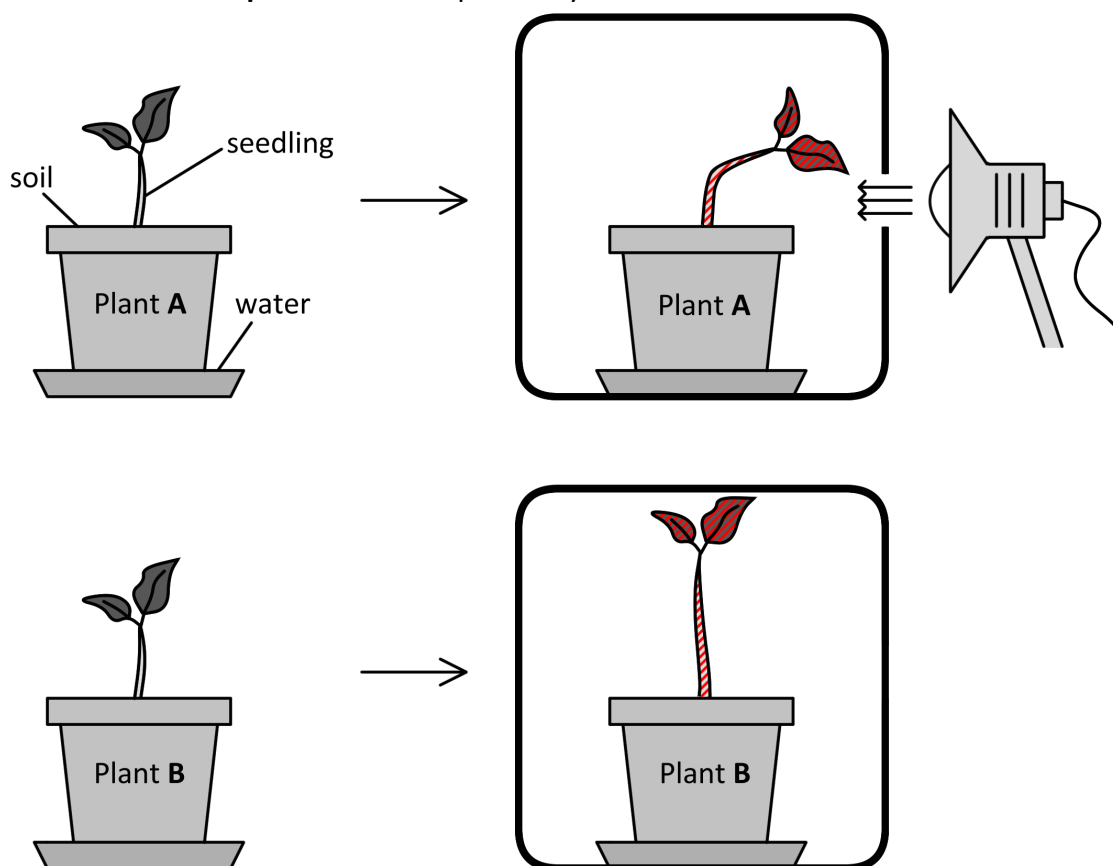
- d) Describe how plant hormones cause directional growth responses in both the shoots and roots of a plant.

Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	A simple description of auxin's role in directional growth in either the shoot or the root. The link between hormone concentration and growth is limited or may be incorrect.
Level 2	3 - 4	A generally correct description of directional growth in both the shoot and the root. Explains that uneven auxin distribution causes differential growth, but does not clearly state how the effect of auxin differs between the shoot and root.
Level 3	5 - 6	A detailed and coherent description for both shoot and root. Correctly explains that auxin accumulation on the lower side promotes elongation in the shoot but inhibits elongation in the root, leading to the observed directional growth.

Indicative Content	
The student's response may include some or all of the following points: - The hormone responsible for the growth response is auxin. - Auxin is produced in the tips of the shoots and roots. - When a plant is on its side, gravity causes auxin to accumulate on the lower side of both the shoot and the root. In the shoot: - A high concentration of auxin stimulates / promotes cell elongation. - This causes the cells on the lower side to grow faster / more than the cells on the upper side. - This results in the shoot growing upwards, which is negative gravitropism (and towards the light, positive phototropism). In the root: - A high concentration of auxin inhibits cell elongation. - This causes the cells on the lower side to grow slower / less than the cells on the upper side. - This results in the root growing downwards, which is positive gravitropism.	
	Total: 6 marks

(Total for Question 3 is 10 marks)

4. A student set up an experiment to investigate the response of a growing plant to the direction of light. The figure below shows a **part drawn** setup used by the student.



Plant A was placed in a dark box that only allowed light to enter the box from one side.
Plant B was placed into a dark box that allowed **no** light to enter the box.

- a) Complete the figure above by **drawing** plant A and plant B, in the boxes, to show the expected direction of their growth after 10 days.

Award 1 mark for the diagram of plant A being similar to the diagram above.	1 mark
Award 1 mark for the diagram of plant B being similar to the diagram above.	1 mark
	Total: 2 marks

- b) Identify what response is being shown by plant A and why is this response an advantage to the plant?

The response shown is (positive) phototropism.	1 mark
This is an advantage because the plant absorbs more light for photosynthesis.	1 mark
	Total: 2 marks

- c) Name the hormones responsible for this response.

Auxins.	1 mark
	Total: 1 mark

- d) What process occurs on the side of the plant **not** facing the stimulus?

The cells on the side not facing the light (the shaded side) grow more/faster.	1 mark
This is because the <u>cells elongate</u> (get longer). Accept cell elongation occurs.	1 mark
	Total: 2 marks

(Total for Question 4 is 7 marks)

5. The figure below shows an seed lying on the soil, a root is beginning to emerge from the seed.

A hormone is made in the root tip of the plant.

The hormone moves through the plant tissues from the tip into the tissues of the root.

- a) Identify the hormone and explain how the hormone causes the appearance of the root in the figure.

An answer that includes any four from the following:	
(Hormone is) <u>auxin</u>. (Due to) gravity, auxin accumulates / builds up. - On the lower side of the root. - High concentration of auxin inhibits cell elongation / growth (in the root). - So, the cells on the upper side elongate more / grow faster, causing the root to bend downwards.	
Allow 'plant growth substance' or 'chemical' for auxin on the first marking point only.	
The point about inhibition is essential for a full explanation.	
	Total: 4 marks

- b) Gravitropism enables plants to survive in their environment.

Explain how gravitropism enables a plant to survive.

An explanation to include:	
Positive gravitropism means roots grow downwards.	1 mark
to anchor the plant and/or absorb water and mineral ions.	1 mark
Or alternatively...	
Negative gravitropism means shoots grow upwards.	1 mark
towards light for photosynthesis.	1 mark
	Total: 2 marks

(Total for Question 5 is 6 marks)

6. Plants produce hormones that control and coordinate their growth and responses. These hormones also have important commercial uses.

Gardeners often take cuttings from plants to grow new, genetically identical plants.

They sometimes dip the base of the cutting into rooting powder before planting it.

- a) Name the plant hormone that is the main active ingredient in rooting powder.

Auxin.	1 mark
	Total: 1 mark

- b) Explain why using rooting powder helps the cutting to grow successfully.

An explanation to include one of the following from:	
Stimulates / encourages / promotes root growth.	1 mark
	Total: 1 mark

Gibberellins are another group of plant hormones.

c) State one natural role of gibberellins in plants (other than stem elongation).

An explanation to include one of the following from:	
- Promoting flowering. - Increasing fruit size. (Initiating / ending dormancy in) seeds / germination.	1 mark
	Total: 1 mark

d) Describe the commercial uses of the plant hormones auxin, gibberellin, and ethene in agriculture. For each hormone, give specific examples and explain how its use is beneficial.

Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	Identifies at least one correct commercial use for a plant hormone. The explanation of the benefit is limited or missing. The answer may only refer to one or two of the required hormones.
Level 2	3 - 4	Describes commercial uses for at least two of the hormones with generally correct explanations. The answer shows a good understanding but lacks the full breadth required by the question.
Level 3	5 - 6	Describes a correct commercial use and a clear, linked benefit for all three named hormones (auxin, gibberellin, and ethene). The answer is detailed, accurate, and covers the full scope of the question.

Any six from the following, with a maximum of two marks per hormone :	
Auxins: <u>Use</u>: as a rooting powder / on cuttings. <u>Benefit</u>: to stimulate root growth / clone plants. OR <u>Use</u>: as a selective weedkiller. <u>Benefit</u>: to kill broad-leaved weeds without harming narrow-leaved crops / grass. Gibberellins: <u>Use</u>: to end seed dormancy / promote germination. <u>Benefit</u>: to ensure seeds germinate at the same time, e.g., for malting in brewing. OR <u>Use</u>: to promote flowering. <u>Benefit</u>: to ensure plants flower earlier than they normally would / out of season. OR <u>Use</u>: to increase fruit size. <u>Benefit</u>: to produce larger grapes / more yield. Ethene: <u>Use</u>: to control fruit ripening. <u>Benefit</u>: allows fruit to be picked unripe (for transport) and then ripened before being sold / reduces spoilage.	
	Total: 6 marks

(Total for Question 6 is 9 marks)